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U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

REPORT NO. 1229

TASK ASSIGNMENT NPG-Re3c-321-4-53

3rd Partial Report

BOMB, DEMOLITION 3000 LB., T55; GUNFIRING TEST OF

FINAL Report

Copy No. 9

Task

Assignment NPG-Re3c-321-4-53

Classification CONFIDENTIAL

54AA-3551

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L L L L

Bomb Demolition 3000 lb. T55; Gunfiring Test of

PART A

SYNOPSIS

1. The tests reported herein were conducted to compare the impact performances of token-loaded and inert-loaded 3000 lb. Demolition Bombs T55.

2. As a result of the test conducted, it is concluded that:

a. The 3000 lb. Demolition Bomb T55, token-loaded, will perform as well as the inert-loaded Bomb T55, both being effective when tested against 10" reinforced concrete at 15° obliquity and 1000 f/s striking velocity, provided that an inert filler with adequate compressive strength is used.

Bomb, Demolition 3000 lb. T55; Gunfiring Test of
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Bomb, Demolition 3000 lb. T55; Gunfiring Test of
-----PART BINTRODUCTION

1. AUTHORITY:

This test was conducted under the authority of Task Assignment NPG-Re3c-321-4-53 in accordance with reference (a) as modified by reference (b).

2. REFERENCES:

- a. BUORD Rest ltr Re3c-LME:lkf F41-6 of 2 Jan 1952
- b. BUORD Rest ltr Re3c-LME:jk F41-6 of 11 Mar 1952
- c. NPG Conf Report No. 945 of 27 Mar 1952
- d. NAVPROV Conf ltr-OT:DDH:ags A11/3c321-4 Ser 35098 of 17 Sep 1953
- e. BOSO 452648

3. BACKGROUND:

The Army Ordnance Department's project for "Research and Development of Bombs for Future Aircraft" includes the development of a 3000 lb bomb, T55. Ballistic tests of inert loaded T55 bombs were conducted by the Naval Proving Ground in the latter part of 1951. Results of these tests were reported in reference (c). Reference (d) reports the results of the first three token loaded 3000 lb Bombs T55 tested at the Naval Proving Ground.

4. OBJECT OF TEST:

The object of this test was to compare the impact performances of token-loaded and inert-loaded 3000 lb Demolition Bombs T55.

Bomb, Demolition 3000 lb. T55; Gunfiring Test of

5. PERIOD OF TEST:

a. Dates of Project Letters	2 Jan 1952 11 Mar 1952
b. Dates Necessary Material Received	2 Dec 1952 26 Oct 1952
c. Date Commenced Test	22 Jul 1953
d. Date Test Completed	4 Nov 1953

6. REPRESENTATIVES PRESENT:

The following persons witnessed the ballistic tests on the dates shown:

<u>Name</u>	<u>Date</u>	<u>Activity</u>
Mr. G. W. Asprooth	2 Nov 1953	Office of the Chief of Ordnance
Mr. H. D. Barnes	2 Nov 1953	A. C. Smith Corp.
Mr. H. S. Beckman	4 Nov 1953	Office of the Chief of Ordnance
LTCOL Cushman	24 Jul 1953	USAF
Mr. S. K. Einbinder	2 Nov 1953	Picatinny Arsenal
Mr. N. W. Frederickson	2 Nov 1953	Office of the Chief of Ordnance
Mr. S. F. Lawrence	2 Nov 1953	Picatinny Arsenal
Mr. F. Ludden	24 and 31 Jul 1953	Office of the Chief of Ordnance
Mr. O'Neil	24 Jul 1953	Office of the Chief of Ordnance
Mr. O. C. Pototschnik	31 Jul and 4 Nov 1953	Office of the Chief of Ordnance
MAJ C. A. Proctor	31 Jul and 4 Nov 1953	USAF
COL J. H. Shea	4 Nov 1953	USAF

Bomb, Demolition 3000 lb. T55; Gunfiring Test of
-----PART CDETAILS OF TEST

7. DESCRIPTION OF ITEM UNDER TEST:

Bomb, Demolition, 3000 lb. T55, as supplied by the Army Ordnance Department for this test was 24" in diameter and 94"5 in length overall. The bombs were token-loaded with tritonal. Three of the bombs contained a charge of approximately 100 lbs. in the nose section. This charge consisted mainly of tritonal with a layer of TNT to separate the tritonal from the inert vermiculite-cement filler. The remaining two bombs contained 60 lbs. of tritonal. The inert filler in one of these bombs was vermiculite-cement and the other was an inert mixture of 81% PCN, (believed to be polychloronaphthalene) 9% Celite and 10% iron oxide. The base of each bomb was fitted with a special base plate to withstand the pressure of propellant gases during gunfiring. This base plate was also fitted with an eye bolt to assist in loading the bomb through the gun muzzle prior to firing. The nose fuze seat liner in each bomb was supported by a machined aluminum plug. The bombs as tested weighed from 2906 lbs to 2996 lbs.

8. DESCRIPTION OF TEST EQUIPMENT:

- a. Gun: 24" Smooth Bore Type A, Mod O, No. 235
- b. Propellant: 5"/38 Smokeless Powder SPDN-9830 plus Black Powder Boosters
- c. Targets: Reinforced concrete blocks constructed according to NPG Dwg. No. 2434 of 10 March 1949

9. PROCEDURE:

The bombs were fired from the 24" smooth-bore gun using a propellant charge of 3 sections of smokeless powder SPDN-9830 (5"/38 caliber) made up in 8"/55 bags. A 5 lb. pad of black powder was attached to each section to assist in proper ignition of the charge. Velocities of the bombs were measured by the standard method of firing through coils and measuring time intervals with recording oscillographs. The target was

Bomb, Demolition 3000 lb. T55; Gunfiring Test of

supported in steel butts and was backed with a large sandpile to stop the bomb and assist in recovery. Each fired bomb was recovered and examined for condition prior to firing the next bomb on this program.

10. RESULTS AND DISCUSSION:

Detailed firing records, butt impact records and photographs of bombs tested are contained in Appendix (A), Table I, Appendix (B) Tables II through VI, and Appendix (C) Figures 1 through 5. Briefly, the results were as follows:

a. The first bomb was fired at a velocity of 1049 ft./sec. at 10" of reinforced concrete set at 15° obliquity. The bomb deflagrated upon impact, resulting in only partial penetration.

b. The second bomb was fired under the same conditions to confirm the results obtained from the first shot. The striking velocity on this shot was 1001 ft./sec.. The bomb did not deflagrate, but it was recovered in an ineffective condition with the nose section broken open and an indication of partial burning of the tritonal filler.

c. The third bomb was fired against 8" of reinforced concrete set at 15° obliquity with a velocity of 1049 ft./sec.. This bomb deflagrated after penetration.

d. At this time, further testing was postponed upon request of the Army Ordnance representatives present at the firing of the third bomb. The two remaining bombs plus metallurgical samples from the fired bombs were shipped by authority of reference (a) to Picatinny Arsenal for examination.

e. It is understood that all three of the above bombs had been made from the same tubing and that the metal in this tubing was defective. Consequently, in November of 1953, two additional bombs, from two different lots, were received to complete the tests.

f. The fourth bomb, lot PAE 13705, with a vermiculite-cement inert filler was fired against 10" reinforced concrete set at 15° obliquity with a striking velocity of 1003 ft./sec.. This bomb was effective and intact with no deformation.

Bomb, Demolition 3000 lb. T55; Gunfiring Test of

g. The last bomb in this test was fired under the same conditions. This bomb was from lot PAE 13704 and contained an inert filler of PCN. This bomb deflagrated after penetration. An analysis of the PCN filler was made and it was determined that PCN has a compressive strength of approximately 350 lbs per sq. in. and a melting point of 91°C. The lack of sufficient compressive strength in the inert filler (compared with the compressive strength of the explosive used) could contribute to the failure of the bomb. A question was raised as to the possibility of a weld existing circumferentially just aft of the ogive of this bomb. Examination by the hot acid etch method was made and it was determined that no weld existed. A photomicrograph of the section under question is contained in Figure 1 of Appendix (D).

PART DCONCLUSIONS

11. As a result of these tests, it is concluded that:

a. The 3000 lb. Demolition Bomb T55, token-loaded, will perform as well as the inert-loaded bomb T55, both being effective when tested against 10" reinforced concrete at 15° obliquity and 1000 ft./sec. striking velocity, provided that an inert filler with adequate compressive strength is used.

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Bomb. Demolition 3000 lb. T55; Gunfiring Test of

The tests upon which this report is based were conducted by:

D. D. HARRIS, Lieutenant, USN
Terminal Ballistics Firing Officer
Terminal Ballistics Department

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Terminal Ballistics Firing Officer
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Commander, Naval Proving Ground



E. A. HUCKNER
Captain, USN
Ordnance Officer
By direction

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NPG REPORT NO. 1229

U. S. NAVAL PROVING GROUND
DAHLGREN, VIRGINIA

Third Partial Report

on

Task Assignment NPG-Re3c-321-4-53

Final Report

on

Bomb, Demolition 3000 lb., T55; Gunfiring Test of

Project No: NPG-Re3c-321-4-53

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Date:

JAN 19 1954

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NPG REPORT NO. 1229

Bomb, Demolition 3000 lb. T55; Gunfiring Test of

TABLE I

SUMMARY OF FIRING CONDITIONS

Date Fired 1953	Bomb Lot No.	Impact No.	Target	Obl.	Pene- tration	Str. Vel. (f/s)	Breech Press (t.s.i.)	Powder Charge	Remarks
22 Jul	JA5-1	41221	10" Conc	15°	Partial	1049	2.6	135 lb of SPDN-9830 Plus 15 lb Black Powder	Bomb deflagrated on impact.
24 Jul	JA5-1	41255	10" Conc	15°	C	1001	2.5	129 lb of SPDN-9830 Plus 15 lb Black Powder	Bomb ineffective nose section broke open - tritonal filler partially burned.
31 Jul	JA5-1	41274	8" Conc	15°	C	1024	2.6	129 lb of SPDN-9830 Plus 15 lb Black Powder	Bomb deflagrated after impact.
2 Nov	PAE- 13705	41586	10" Conc	15°	C	1003*	2.5	129 lb of SPDN-9830 Plus 15 lb Black Powder	Bomb effective and intact with no deformation
4 Nov	PAE- 13704	41587	10" Conc	15°	C	1024	2.5	129 lb of SPDN-9830 Plus 15 lb Black Powder	Bomb deflagrated after impact

*12 ft/sec.
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APPENDIX A

REF: (a)

NPG Conf Report No. 1229 of

TEST OBJECT

Test of 3000% Demolition Bomb T55E5 Tritonal loaded

IMPACT NUMBER

41255

DATE OF IMPACT

7-24-53

BUTT NO

F

CONCRETE XXXX BLOCK		BOMB XPRONG	
GAUGE 10"0	CLASS	CALIBER 24"	TYPE U. S. Bomb
MANUFACTURER	CONTRACT	MANUFACTURER Joliet Arsenal	LOT NO JA-5-1
GROUP	NO #5	MARK T55E5	MOO
DIMENSIONS 10" x 15" x 15"		PROJECTILE NO	YEAR OF SPECIFICATION
IMPACT DATA		CAPPED <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	LENGTH (Uncapped)
OBLIQUITY 15°	PENETRATION	WEIGHT (Capped)	WEIGHT (Uncapped) 2996#
THICKNESS AT IMPACT	NO. OF IMPACT ON PLATE	FUZE	FILLER TNT and Tritonal 90% Vermiculite-cement
DISTANCE FROM NEAREST IMPACT	THROUGH OPENING	CONDITION AFTER FIRING <input type="checkbox"/> EFFECTIVE <input checked="" type="checkbox"/> INEFFECTIVE	
DISTANCE FROM <input type="checkbox"/> TOP <input type="checkbox"/> BOTTOM	DISTANCE FROM <input checked="" type="checkbox"/> RIGHT <input type="checkbox"/> LEFT	Bomb ineffective - nose section broken open: Tritonal filler partially burnt.	
FLAKING FRONT	FLAKING BACK		
SPUR	DISH		
CRACKS	BULGE		
BUTTON <input type="checkbox"/> THROWN <input type="checkbox"/> STARTED			
VELOCITY (F.S.)			
DESIRED	OBTAINED	<input type="checkbox"/> MUZZLE <input type="checkbox"/> STRIKING <input checked="" type="checkbox"/> MEAN	1001

REMARKS

SPDN-9830 = 3 sections, 43.0# each
+ 1-5# B.P. Booster each section

DATE	TIME	RECOMMENDATION <input type="checkbox"/> ACCEPT <input type="checkbox"/> REJECT
SIGNATURE L. D. BARRIS		TITLE PLATE BATTERY OFFICER

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TABLE II

APPENDIX B

NAVY DDPH PRNC, WARR., D.C.

REF: ()

NPG Conf Report No. 1229 of

TEST OBJECT Test of 3000% Demolition Bomb T55E5 Tritonal Loaded		IMPACT NUMBER 41221	
		DATE OF IMPACT 7-22-53	
		BUTT NO F	
CONCRETE BLOCK		BOMB	
GAGE 10" 0	CLASS	CALIBER 24"	TYPE U. S. Bomb
MANUFACTURER	CONTRACT	MANUFACTURER Joliet Arsenal	LOT NO -
GROUP	NO #5	MARK T55E5	MOD -
DIMENSIONS 10" x 15" x 15"		PROJECTILE NO	YEAR OF SPECIFICATION -
IMPACT DATA		CAPPED <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	LENGTH (Uncapped) -
OBliquITY 15°	PENETRATION	WEIGHT (Capped)	WEIGHT (Uncapped) 2986#
THICKNESS AT IMPACT	NO. OF IMPACT ON PLATE	FUZE	FILLER T and Tritonal- 90% Vermiculite-cement
DISTANCE FROM NEAREST IMPACT	THROUGH OPENING	CONDITION AFTER FIRING <input type="checkbox"/> EFFECTIVE <input checked="" type="checkbox"/> INEFFECTIVE	
DISTANCE FROM <input type="checkbox"/> TOP <input type="checkbox"/> BOTTOM	DISTANCE FROM <input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT	Bomb deflagrated upon impact.	
FLAKING FRONT	FLAKING BACK		
SPLUR	DISH		
CRACKS	BULGE		
BUTTON <input type="checkbox"/> THROWN <input checked="" type="checkbox"/> STARTED			
Impact Dimens:		VELOCITY (F.S.)	
DESIED	OBTAINED	<input type="checkbox"/> MUZZLE <input type="checkbox"/> STRIKING <input checked="" type="checkbox"/> MEAN	1049

Chg: 135% SPDN-9830, + 1-5% BP Booster each section
3 sections: 45% each

Time fired: 1205

Gun: 24" Type A-0 #235

c/d	f(s/d,0)	RECOMMENDATION <input type="checkbox"/> ACCEPT <input type="checkbox"/> REJECT
SIGNATURE /s/ D. D. HARRIS		TITLE PLATE BATTERY OFFICER

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TABLE III

APPENDIX B

NAVY-OPPO PRNC, WASH., D.C.

REF: (•)

NPG Conf Report No. 1229 of

TEST OBJECT		IMPACT NUMBER 41274	
Test of 3000% Demolition Bomb T55 Tritonal Loaded		DATE OF IMPACT 7-31-53	
		BUTT NO F	
CONCRETE	BLOCK	LORE	BRICK
GAUGE 870	CLASS	CALIBER 24"	TYPE T55 - U. S.
MANUFACTURER	CONTRACT	MANUFACTURER Joliet Arsenal	LOT NO JA-5-1
GROUP	NO #1	MARK	MOD
DIMENSIONS 8" x 15' x 15'		PROJECTILE NO	YEAR OF SPECIFICATION
IMPACT DATA		CAPPED <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	LENGTH (Uncapped)
OBLIQUITY 15°	PENETRATION Complete	WEIGHT (Capped)	WEIGHT (Uncapped) 2973
THICKNESS AT IMPACT 870	NO. OF IMPACT ON PLATE 1	FUZE	FILLER TNT and Tritonal 90%
DISTANCE FROM NEAREST IMPACT 0	THROUGH OPENING 52" x 65	CONDITION AFTER FIRING <input type="checkbox"/> EFFECTIVE <input checked="" type="checkbox"/> INEFFECTIVE	Vermiculite-cement
DISTANCE FROM <input checked="" type="checkbox"/> TOP <input type="checkbox"/> BOTTOM 129"	DISTANCE FROM <input type="checkbox"/> RIGHT <input checked="" type="checkbox"/> LEFT 102"	Bomb deflagrated after penetration:	
FLAKING FRONT 59" x 70"	FLAKING BACK 58" x 70"	split open	
SPUR none	DISH none		
CRACKS none	BULGE none		
BUTTON <input checked="" type="checkbox"/> THROWN <input type="checkbox"/> STARTED			
Impact Dimens: 55" x 69"		VELOCITY (F.S.)	
DESIRED	OBTAINED	<input type="checkbox"/> MUZZLE <input type="checkbox"/> STRIKE	<input checked="" type="checkbox"/> MEAN 1024

SPLN-9830, 3 sections, 43% each, total 129%
+ 1-5% BP Booster each section

GUN: 2470 Mk Type A - O #235

c/d	F(+/-0)	RECOMMENDATION <input type="checkbox"/> ACCEPT <input type="checkbox"/> REJECT
SIGNATURE /s/ D. D. HARRIS		TITLE PLATE BATTERY OFFICER

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TABLE IV

APPENDIX B

NAVY OPNAV PRNC, WASH., D.C.

REF: (a)

NPG Conf Report No. 1229 02

TEST OBJECT				IMPACT NUMBER 41586	
Test of 3000 lb Demolition Bomb T55E3 Tritonal Loaded				DATE OF IMPACT 11-2-53	
				BUTT NO Butt F	
CONCRETE PAE BLOCK		BOMB XXXXXXXX			
GAUGE 10"	CLASS	CALIBER 24"	TYPE Bomb		
MANUFACTURER NPG	CONTRACT	MANUFACTURER A.O. Smith Corp.	LOT NO PAE 13705		
GROUP	NO #13	MARK T55E3	MOO		
DIMENSIONS 10" x 10' x 12'		PROJECTILE NO #1	YEAR OF SPECIFICATION		
IMPACT DATA		CAPPED <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	LENGTH (Uncapped)		
OBLIQUITY 15°	PENETRATION Complete	WEIGHT (Capped)	WEIGHT (Uncapped) 2940;		
THICKNESS AT IMPACT 10"	NO. OF IMPACT ON PLATE #1	FUZE	FILLER Vermiculite-Cement #60 Tritonal (EO/20)		
DISTANCE FROM NEAREST IMPACT 0	THROUGH OPENING 32" x 33"	CONDITION AFTER FIRING <input checked="" type="checkbox"/> EFFECTIVE <input type="checkbox"/> INEFFECTIVE			
DISTANCE FROM <input checked="" type="checkbox"/> TOP <input type="checkbox"/> BOTTOM 66"	DISTANCE FROM <input type="checkbox"/> RIGHT <input checked="" type="checkbox"/> LEFT 59"	Bomb effective and intact; no deformation; base plate torn off.			
FLAKING FRONT 70" x 78"	FLAKING BACK 68" x 74"				
SPUR 0	DISH 0				
CRACKS 0	BULGE 0				
BUTTON <input checked="" type="checkbox"/> THROWN <input type="checkbox"/> STARTED					
VELOCITY (F.S.)					
DESIRED	OBTAINED	<input type="checkbox"/> MUZZLE	<input type="checkbox"/> STRIKING	Est. 1003±12	

Wt. of Chg.: **129# SPDN-9630, 3 sections, 43# per section
+ 3-5# BP Booster**

Guns: **24" Type A-0 #235**

7/d	T(x/d,θ)	RECOMMENDATION <input type="checkbox"/> ACCEPT <input type="checkbox"/> REJECT	
SIGNATURE /s/ D. D. HARRIS		TITLE PLATE BATTERY OFFICER	

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TABLE V

APPENDIX B

BATT-BDPO PRNC, WARR., D.C.

REF: (a)

NPG Conf Report No. 1229 of

TEST OBJECT

Test of 3000# Demolition Bomb T55E3 Tritonal loaded

IMPACT NUMBER 41587
DATE OF IMPACT 11-4-53
BUTT NO F

CONCRETE TEST BLOCK		BOMB XXXXXXXX	
GAUGE 10"	CLASS	CALIBER 24"	TYPE Bomb
MANUFACTURER NPG	CONTRACT	MANUFACTURER A.O. Smith Corp.	LOT NO PAE 13704
GROUP	NO 14	MARK T55E3	MOO
DIMENSIONS 10" x 10" x 12"		PROJECTILE NO #2	YEAR OF SPECIFICATION
IMPACT DATA		CAPPED <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	LENGTH (Uncapped)
OBLIQUITY BLOCK BURSTED	PENETRATION	WEIGHT (Capped)	WEIGHT (Uncapped) 2908#
THICKNESS AT IMPACT NO MEASUREMENTS	NO. OF IMPACT ON PLATE	FUZE	FILLER PCN 60% Tritonal (80/20)
DISTANCE FROM NEAREST IMPACT	THROUGH OPENING	CONDITION AFTER FIRING <input type="checkbox"/> EFFECTIVE <input checked="" type="checkbox"/> INEFFECTIVE	
DISTANCE FROM <input type="checkbox"/> TOP <input type="checkbox"/> BOTTOM	DISTANCE FROM <input type="checkbox"/> RIGHT <input type="checkbox"/> LEFT	Deflagrated after penetration;	
FLAKING FRONT	FLAKING BACK	split open	
SPUR	DISH		
CRACKS	BULGE		
BUTTON <input type="checkbox"/> THROWN <input type="checkbox"/> STARTED			

VELOCITY (F.S.)

DESIRED	OBTAINED	<input type="checkbox"/> MUZZLE	<input type="checkbox"/> STRAIN	<input checked="" type="checkbox"/> MEAN 1024
---------	----------	---------------------------------	---------------------------------	--

REMARKS

Wt. of Chg.: **129# SPDN-9830**
3 sections: 43# per section
+ 3-5# PB Boosters

Gun: **24" MK A-0 #235**

c/d	F(c/d,0)	RECOMMENDATION <input type="checkbox"/> ACCEPT <input type="checkbox"/> REJECT
SIGNATURE /s/ D. D. HARRIS		TITLE PLATE BATTERY OFFICER

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TABLE VI

APPENDIX B

NAVY OPN: PRMC, WASH., D.C.

NP9-63906

Impact No.
41221

22 July 1953

Obliquity
15°

Thickness
10" cone

Striking vel. (f/s)
1049

FIGURE 1

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Penetration
Partial

Remarks
Bomb deflagrated
upon impact.



NP9-63907

Impact No.
41255

Obliquity
15°

Thickness
10" conc

Striking
Vel. (f/s)
1001

Penetration
C

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Remarks

Bomb ineffective-nose section
broken open-partial burning
of tritonal filler.

FIGURE 2



NP9-63908

Impact No.
41274

31 July 1953

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Obliquity
15°

Thickness
8" conc

Striking vel. (f/s)
1024

Penetration
C

Remarks
Bomb deflagrated
after impact.

FIGURE 3



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2 November 1953

MP9-64605

Impact No.
41586

Oblliquity
15°

Thickness
10" conc

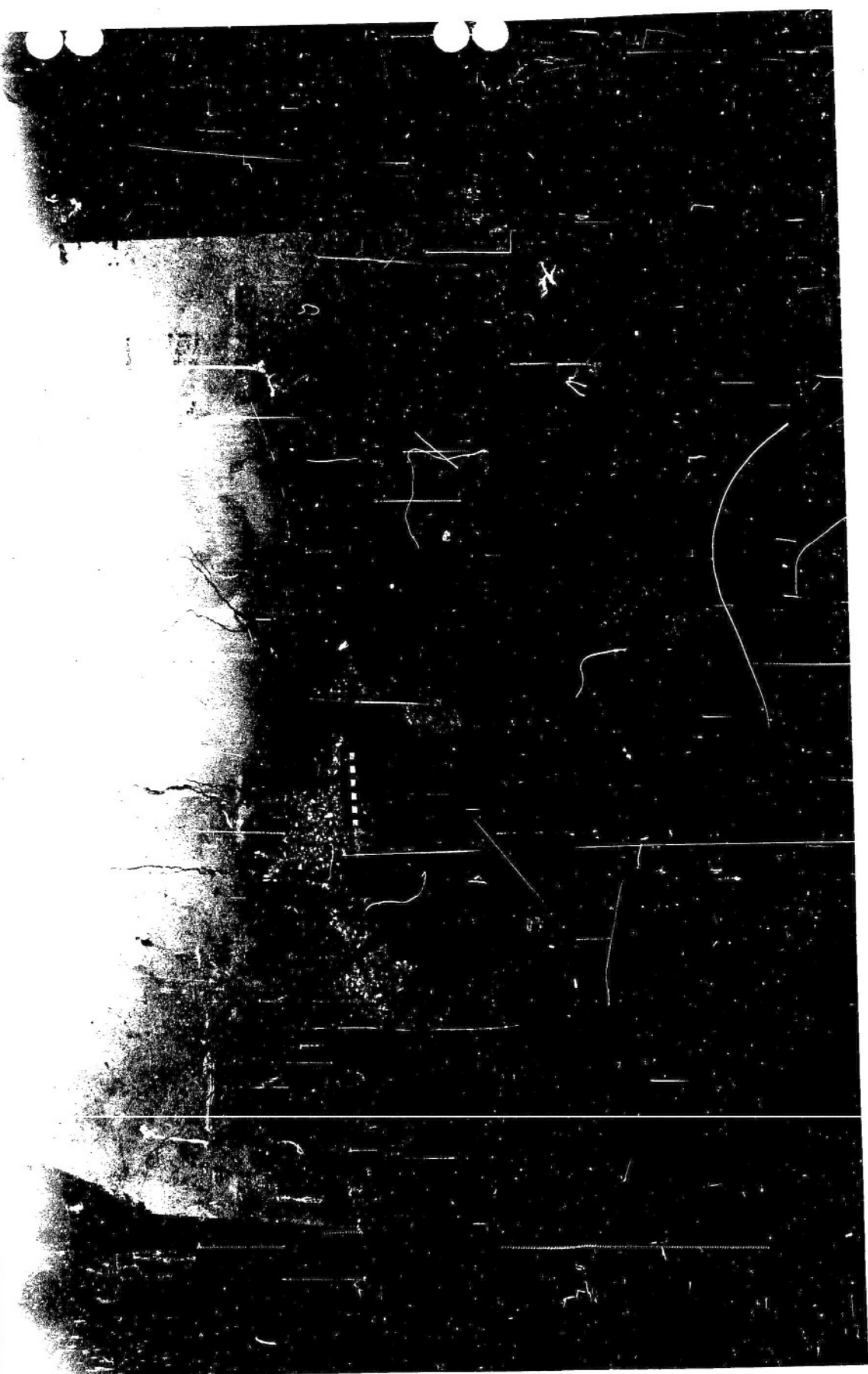
S.V.(f/s)
1003±12

Penetration
C

Remarks
Bomb effective and intact.
No deformation.

Appendix C

Figure 4





Section through fracture of
3000 lb. F-35 Demolition Bomb after gun fire test.
Etched with 50% HCl - 50% H₂O for 20 minutes at 160°F.
Magnification 6.4 X

NP9-64537

Figure 6

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Appendix D

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Bomb, Demolition 3000 lb. T55; Gunfiring Test of

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Bomb, Demolition 3000 lb. T55; Gunfiring Test of

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Aberdeen, Maryland.

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